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Vulcanite Pamphlet No. 8

Second Edition

REINFORCED CONCRETE FOR HOUSES



By
Benjamin A. Howes
Engineer

Published for Gratuitous Distribution

BY

Vulcanite Portland Cement Co.

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Reinforced Concrete Residence of M. F. Griggs, Ardsley-on-Hudson, New York. R. W. Gardner, Architect
Benj. A. Howes, Engineer and Contractor. Vulcanite Used Exclusively



Reinforced Concrete Residence of Alexander S. Cochran, Eastview, New York. R. W. Gardner, Architect
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THE CONCRETE REVIEW

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REINFORCED CONCRETE FOR HOUSES.*

BY BENJAMIN A. HOWES,
Engineer.

MR. PRESIDENT AND GENTLEMEN:

Despite the ominous sound of the subject on which I am announced to speak to you this morning—Architectural Details in Reinforced Concrete—I shall not venture to invade the province of the architect. The builder does not begin by questioning the æsthetic value and meaning of the details which are furnished him to execute.

His not to reason why,
His but to do and die!

Only—after he *has* died—it may be permitted to him to inquire how it all came about, and whether he might not have been safe after all by doing things that were possible and simple, rather than needlessly complicated. What I shall try to do is to show you the results and conclusions of seven years' experience in trying to make things out of concrete, and why some things are easy, economical, and durable, and others unpractical and costly, and, in general, how the problem of the concrete house looks from the point of view of the man who has to build it.

Of course, the tendency, in this formative state of concrete construction, is to have designed a nondescript building that can be carried out in any material, which the owner afterward decides on according to the amounts of the bids. But this procedure does not get the best results. Just because some things are easy and economical in concrete, and others difficult out of all proportion to their æsthetic effect, the owner who wants concrete must decide on it

* An Address given before The Association of American Portland Cement Manufacturers, Hotel Astor, New York, December 15, 1909.

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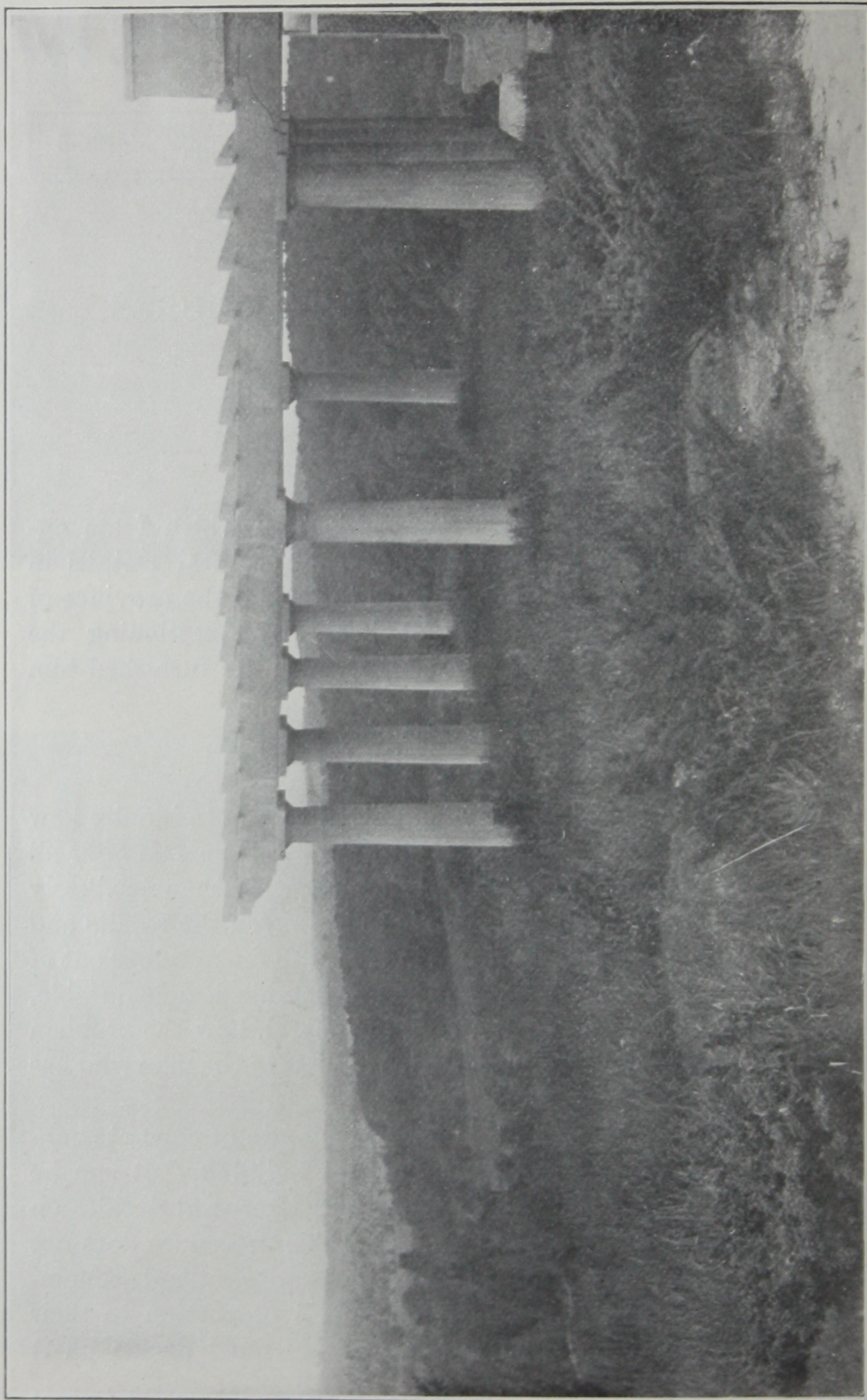


Fig. 1.—Pergola, Residence of S. B. Pearmain, Esq., Framingham, Mass.
Designed by Mrs. Pearmain. Benj. A. Howes,
Engineer and Builder.

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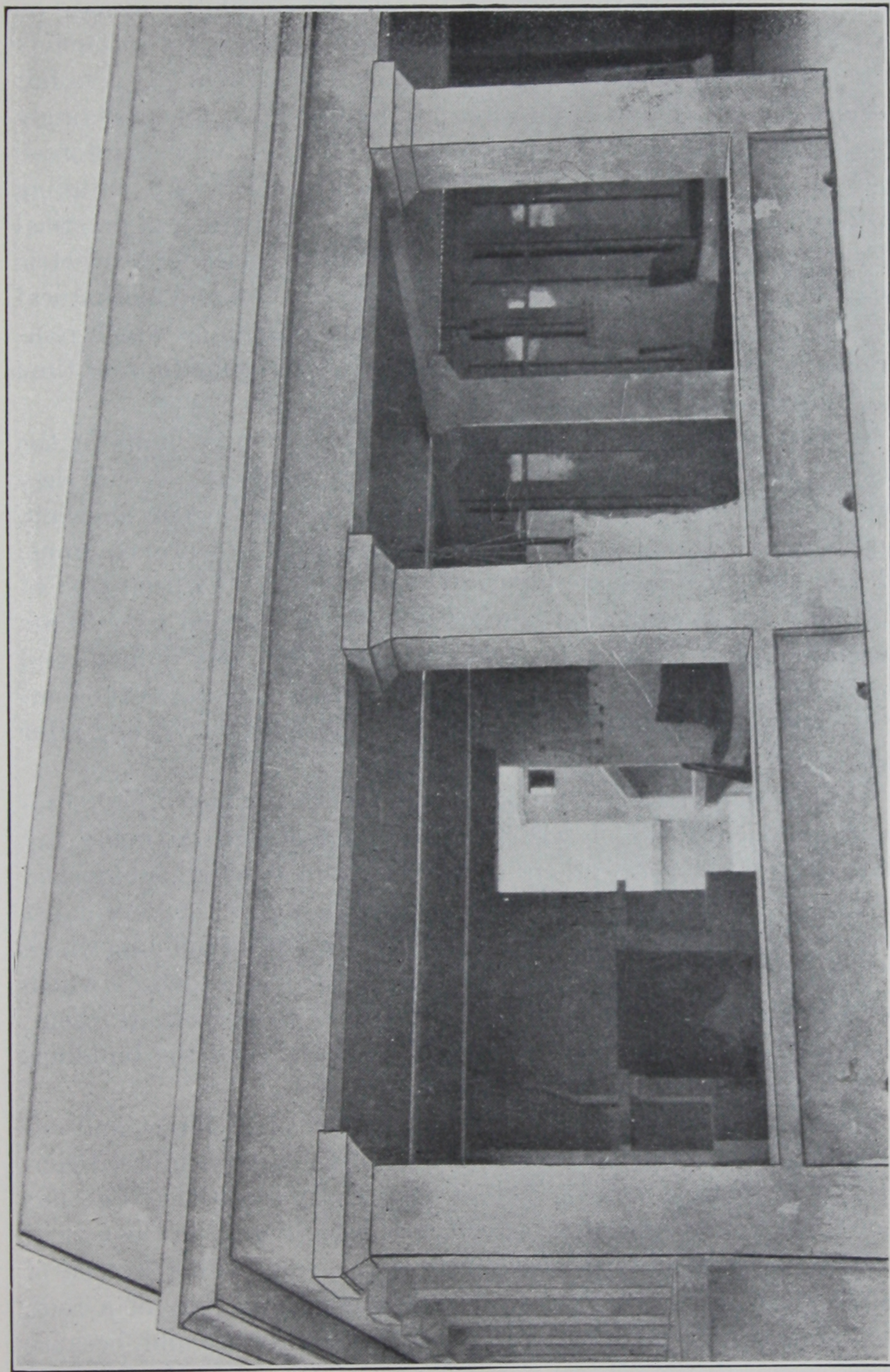


Fig. 2.—Roof loggia, Pearmain house.

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before the plans are drawn. Any other method is unfair to both sides. It is unfair to the engineer because he can only estimate on the detailed plans before him, and naturally his figure for a concrete house not originally planned for concrete must be high. It is unfair to the architect, because some of his best effects, unsuspectingly arranged for masonry or timber, will prove ineffective in reinforced concrete. Reinforced concrete construction is a new art, entailing consultation between the architect and engineer or builder of practical experience, exactly as the installation of a vacuum cleaner or electric clock system entails conference between the architect and mechanical man. Thus all the attractive effects and the economies which reinforced concrete makes possible can be secured at a minimum of time and trouble.

To take a very simple example (Fig. 1). The columns in the pergola I am showing were very inexpensive to construct because they have twenty *flat* sides and could be made with board marks showing. They have the same play of light and shade as true Doric columns, and at a short distance are identical. But if they had been part of a Colonial house, with true Doric *hollow* flutes, handed over to me to execute from the plans, the cost, because of the very difficult and fussy work, would have been prohibitive—to say nothing of the danger of breaking the sharp arris of those flutings both during and after construction.

In the group of views to follow there are some which I have previously published, which are nevertheless adduced to make my points clear; there are others of work still in a rough, unfinished state, for which I do not apologize, inasmuch as it is the very latest devices and solutions in this rapidly advancing type of building which will interest you. Nor do I lay much stress on the details which have proved impracticable—there is no need to perpetuate them; better to illustrate the positive side of the case. All the buildings are of my own execution.

Let us suppose, then, that by coöperation of architect and engineer the general type of house is to be adjusted to reinforced concrete. It will then have a flat or gently sloping roof. The flat concrete roof offers many pleasant possibilities (Fig. 2) in the way of loggia, roof-fireplace, roof-garden, etc. The same thing is true of this variation (Fig. 3). But, as you see, it is only part of a roof, which, however attractive in appearance, was costly to build, because it was, except in the central portion, much broken up, sloping, and laid with beautiful tile. I may say that here the hearty coöperation

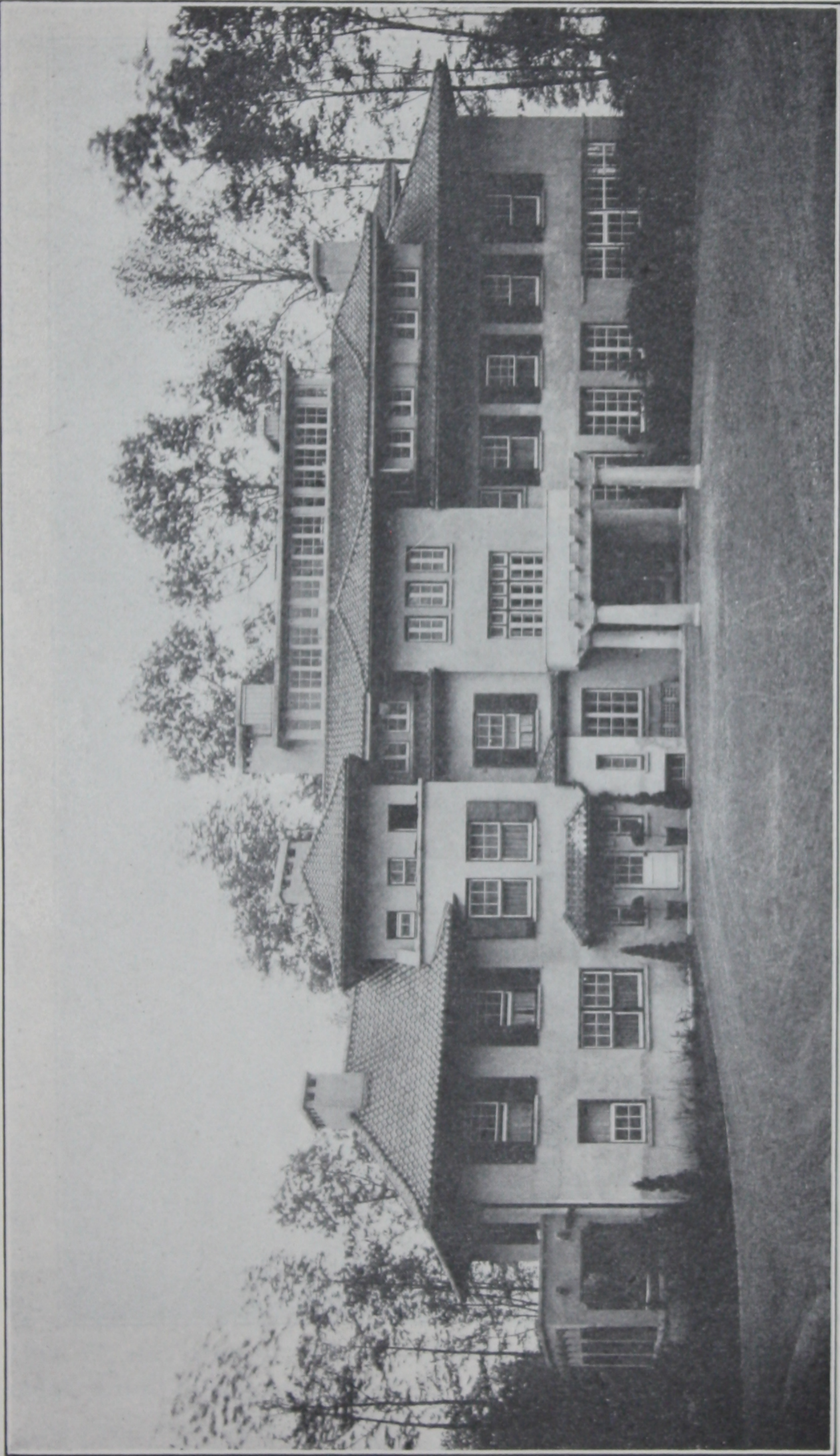


Fig. 3.—Residence of Wm. C. DeLanoy, Esq., Short Hills, N. J. John A. Gurd, Architect; Benj. A. Howes, Engineer and Builder.

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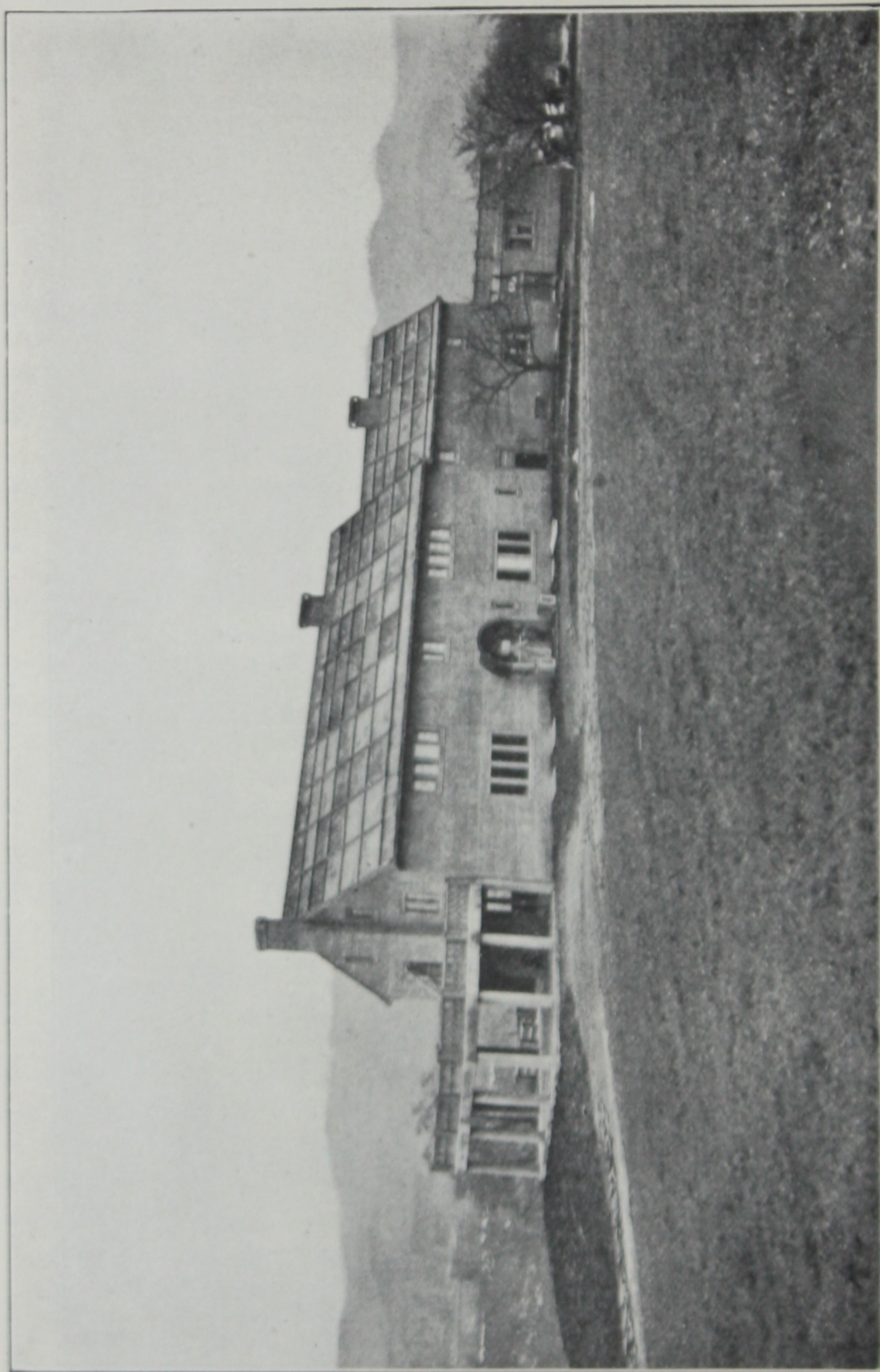


Fig. 4.—Residence of Hinsdale Smith, Esq., South Hadley, Mass. Kirkham and Parlett, Architects; Benj. A. Howes, Engineer and Builder.

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of the architect with the builder served greatly to simplify this necessarily complicated roof.

Another solution for the roof is tile on wooden frame, which would seem practically unburnable and not costly, especially if asbestos tile or slate is used. Yet a well-known architect objected to me only the other day that he personally considered the roof the most vulnerable part of a house, and that if building for himself, he should make it of concrete.



Fig. 5.—Adjustment of roof-slabs, Hinsdale Smith house.

To meet the desire for a sloping roof not too costly, I will next show you a device of my own (which has not been tried elsewhere so far as I know). The usual sloping rafters were cast of concrete and swung into place, the ridge pole being afterward cast between them (Fig. 5). The slabs were cast separately and adjusted as shown (Fig. 5), and later the whole roof was stained, after much experiment, a dull blue-green (Fig. 4).

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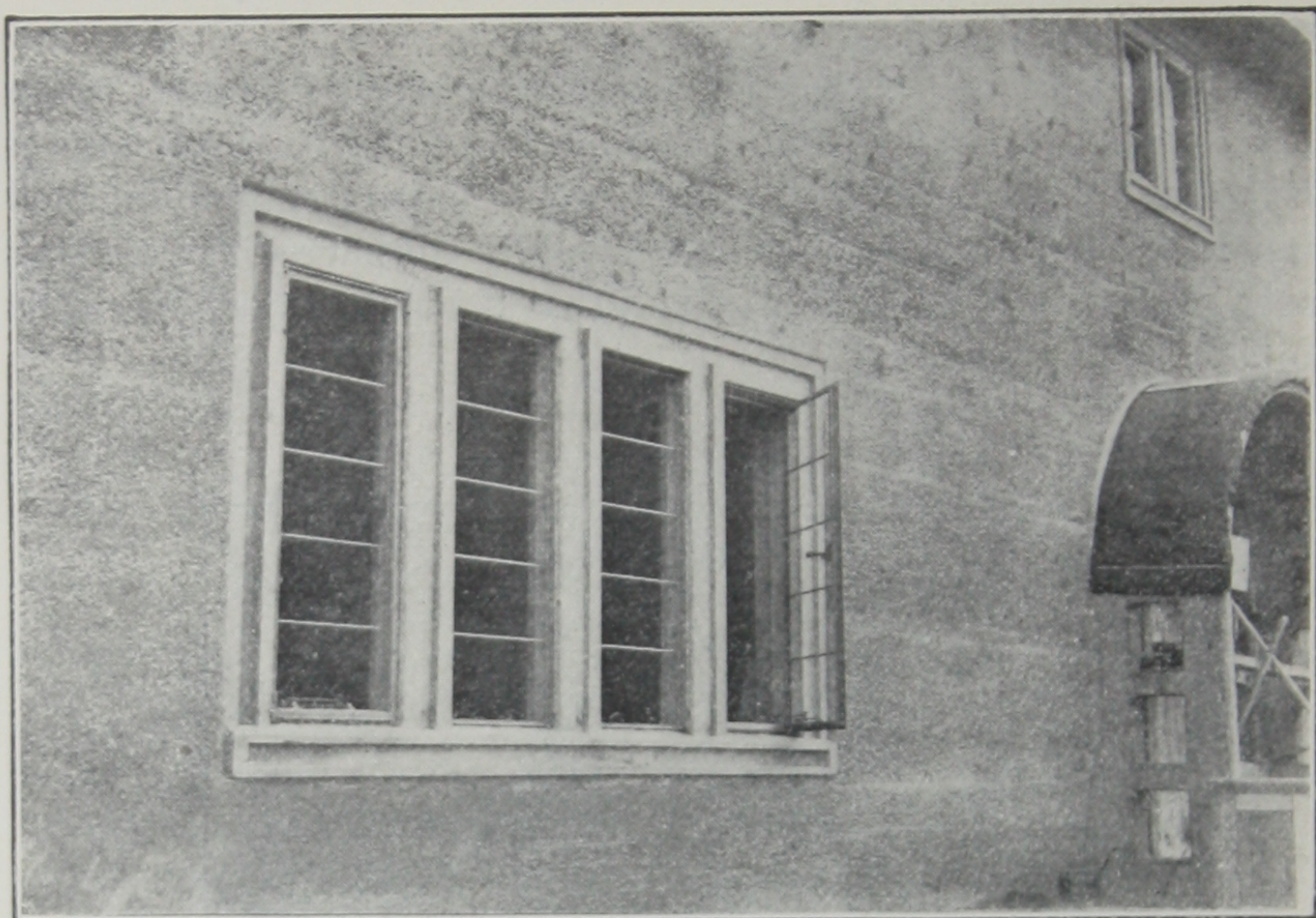


Fig. 6.—Metal windows, Hinsdale Smith house.

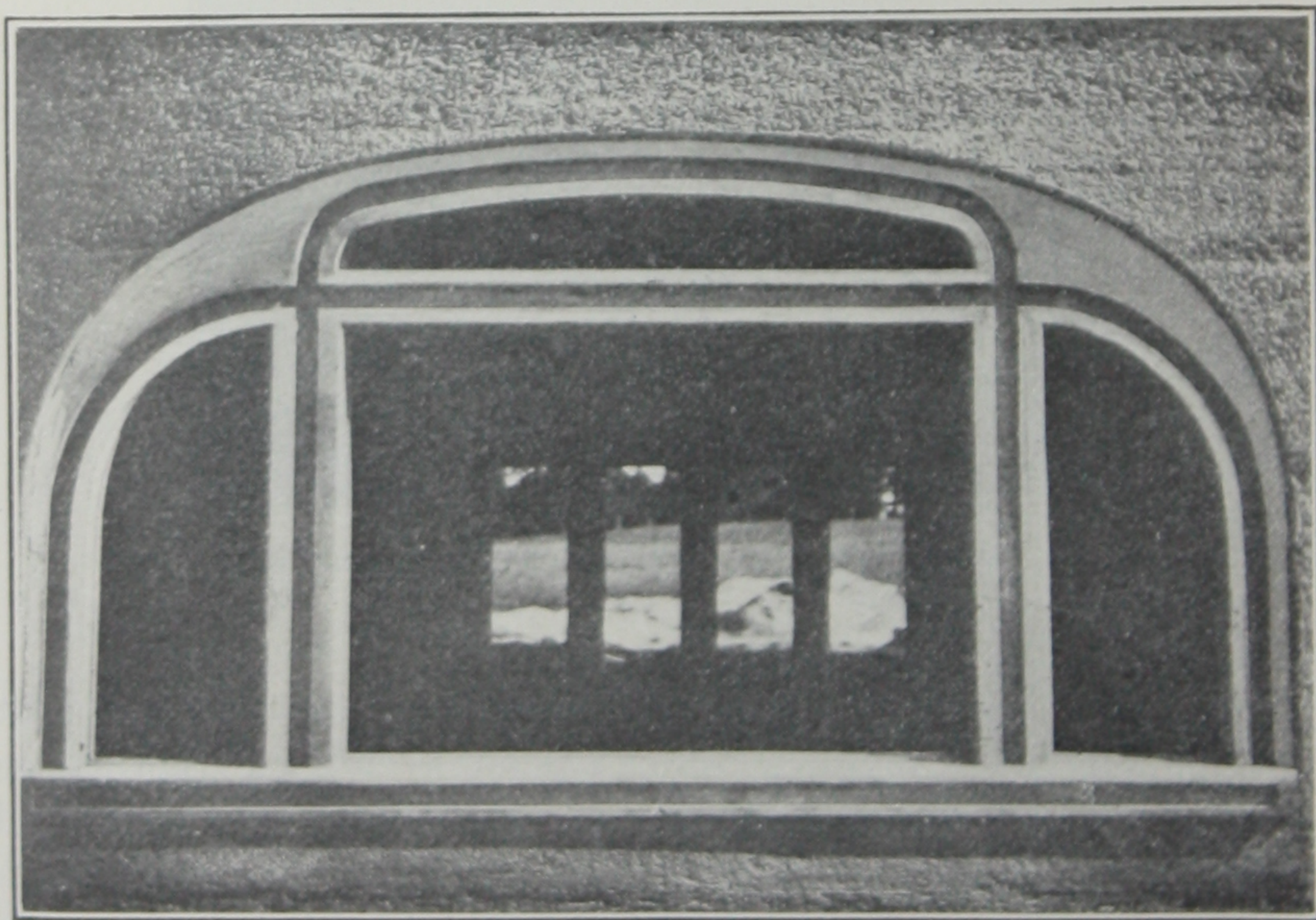


Fig. 7.—Showing wall-texture, Hinsdale Smith house.

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A question that is often raised by prospective home-builders is the treatment of the windows of a concrete house; at first thought wooden window-framings seem incongruous, brick facings do not always suit the general scheme, and, in general, a bare look to the unrelieved window is feared. One way of meeting the problem is the grouping of the windows, and then a double relief, first by the contrast in texture about the windows and the wall, and then by variations in the panes themselves. But no matter what the æsthetic relief, there is always for the builder a difficulty in getting the wooden

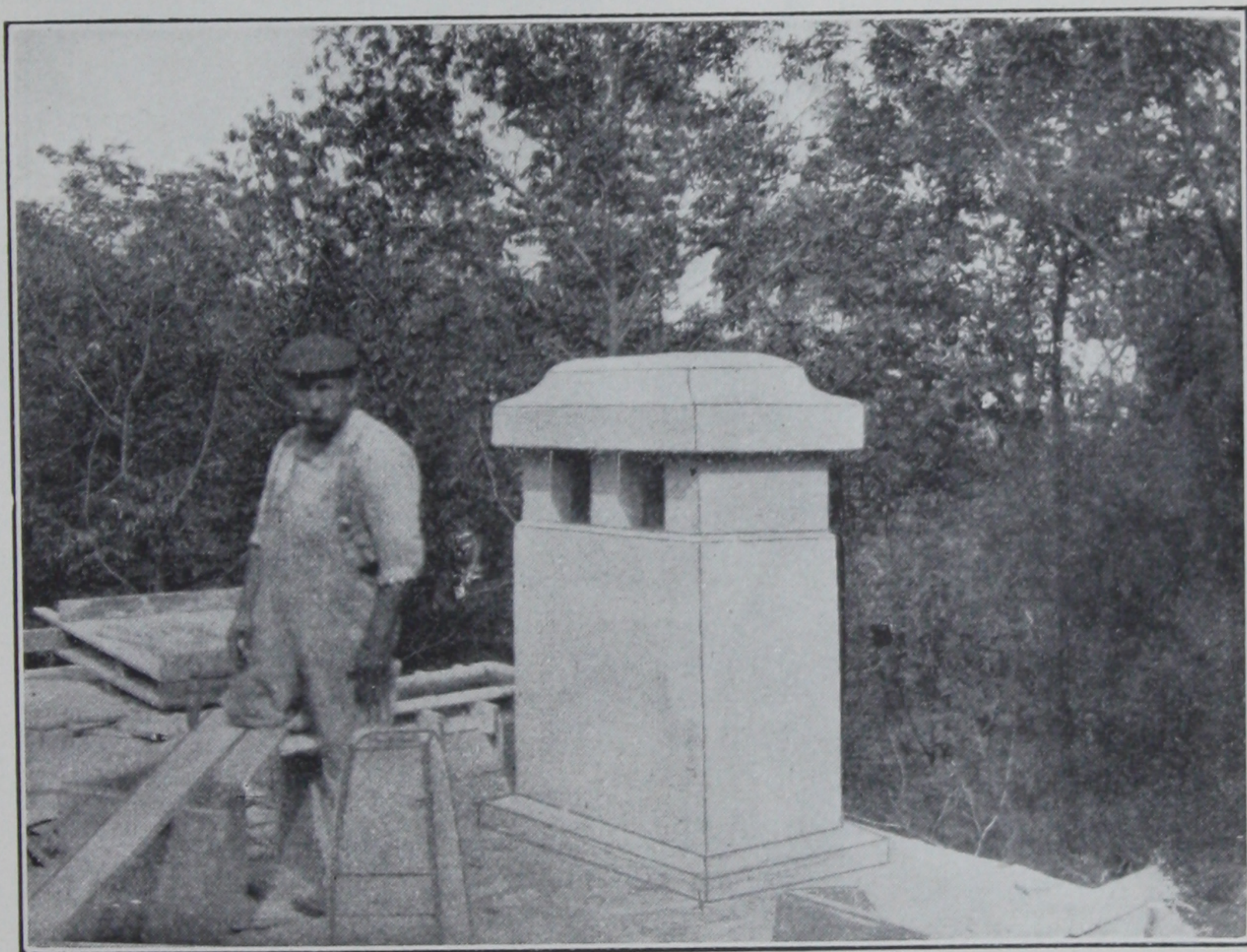


Fig. 8.—Chimney, DeLanoy house.

frame into the wall so as to be weatherproof. Only in a recent house has a perfectly satisfactory solution been reached in the form of a casement with sash and steel frame made so as to fit directly into a rabbet in the concrete (Fig. 6). The groove which is seen around the window will later receive a decorative mosaic filling.

A word might be said here as to the curve of these windows, and of concrete arches generally. The popular distaste for the circular curves seen in the so-called mission style of architecture when applied to reinforced concrete, is a perfectly sound instinct.

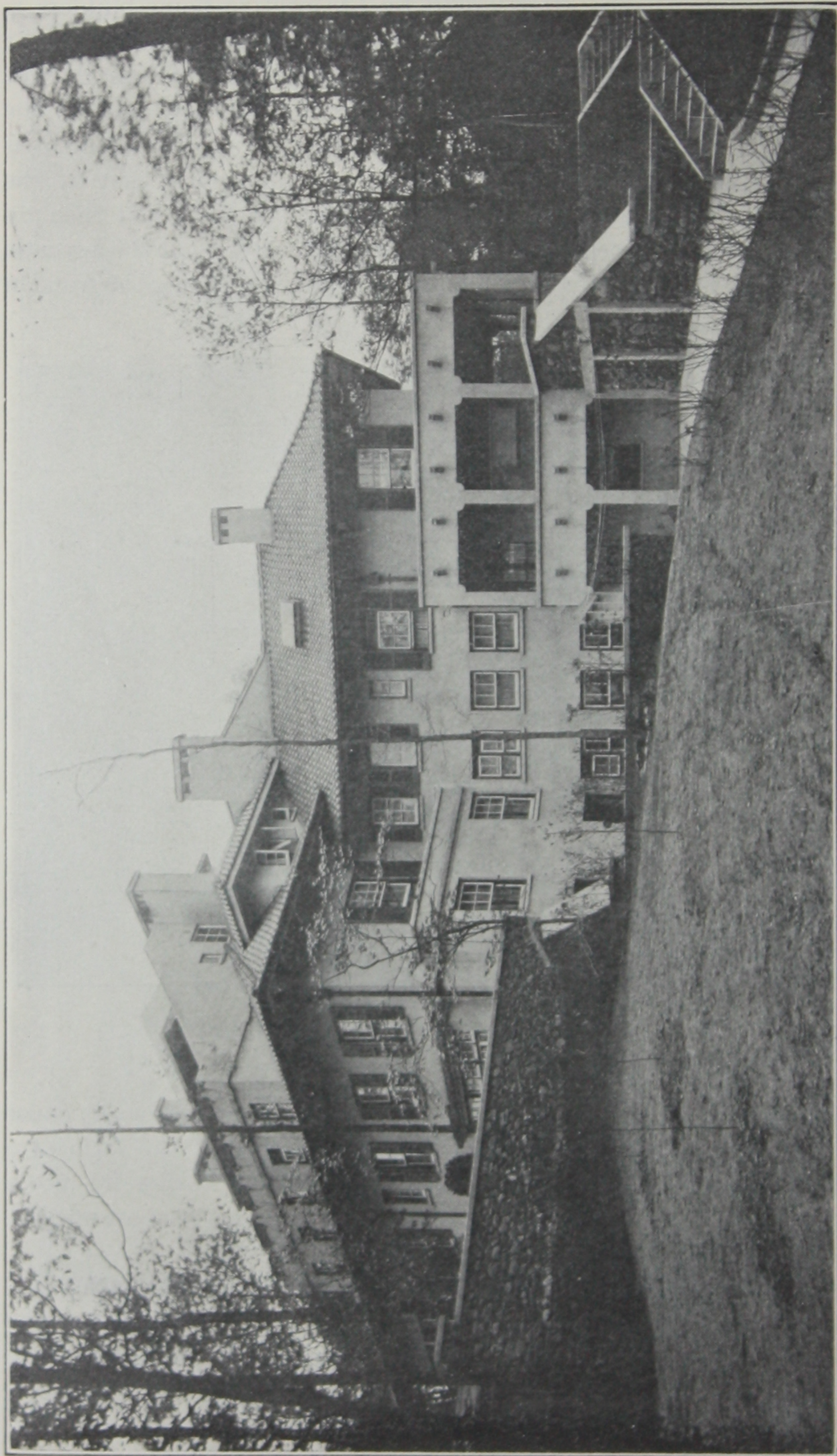


Fig. 9.—Service wing and court, DeLanoy house.

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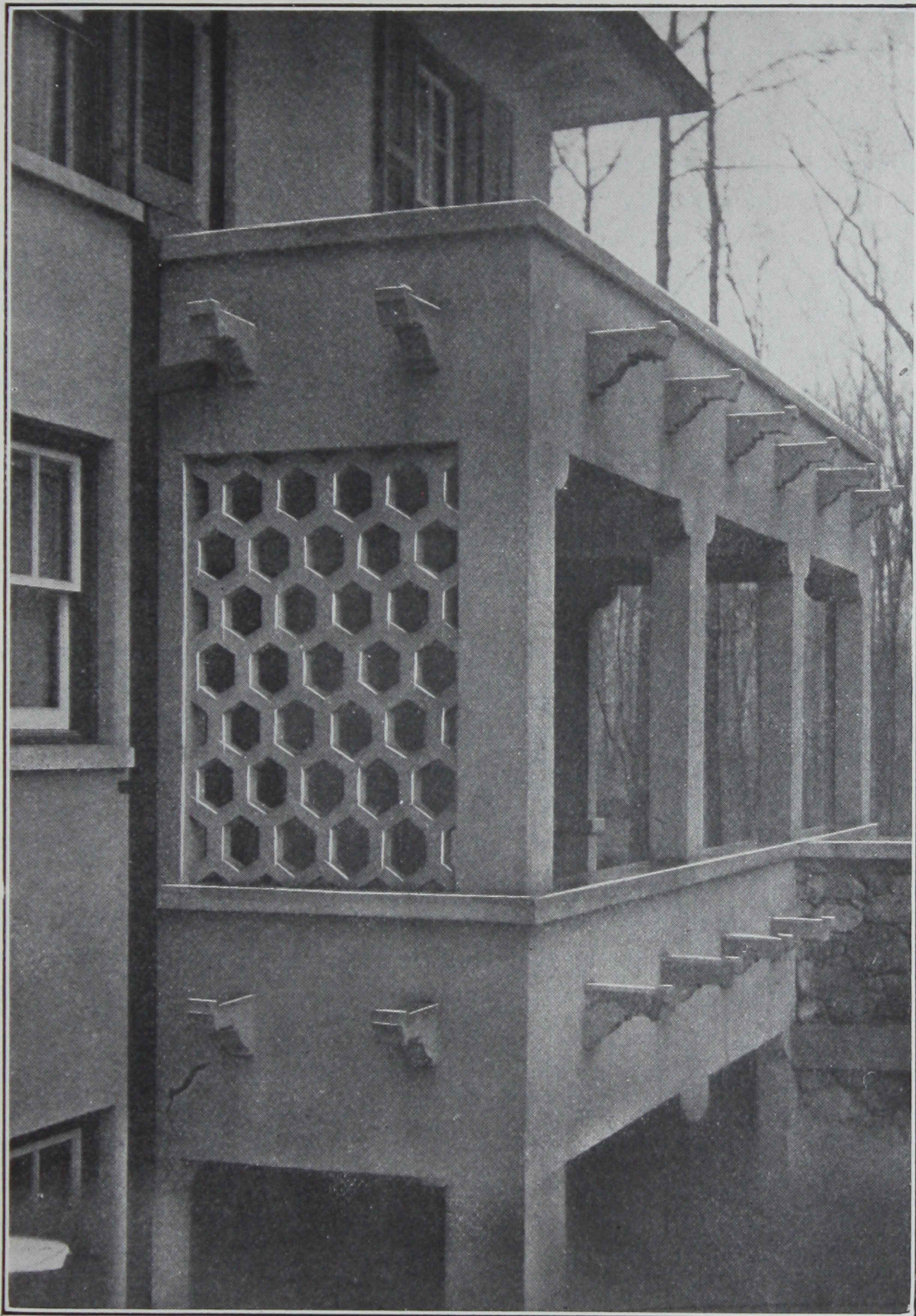


Fig. 10.—Grille, servants' entrance, DeLanoy house.

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These circular curves made an easy rule-of-thumb for the cheap masonry in which they were developed, or the wood and stucco copies, but the true structural line of economy and engineering skill for reinforced concrete is the graceful flattened arch seen in many reinforced concrete bridges (Fig. 7). In fact, the casual observer can usually satisfy himself whether a given house is of true reinforced concrete or not, by noticing the arch curves. If these are circular, the house is practically certain to be plaster.

Other details more or less closely bound up with the æsthetic effect are balustrades, chimneys, etc. To this audience I need not go into technical reasons for preferring large rounded or simple panelled forms or railings to complicated forms which are imitative of cut stone or turned wood. In general, to venture an expression of taste, wrought-iron railing seems to fit concrete better than bronze does, which in its delicacy goes better with cut stone.

The chimneys, too, are not unworthy of attention. The accompanying shape (Fig. 8) is well adapted, with its rounded, gentle slopes, to execution in concrete. Also note chimneys in Fig. 4.

The service court and servants' entrance is another problem too often slighted (Fig. 9). The advantage of the concrete court in two stories is obvious. Note the concrete brackets for flower-boxes. The grille (Fig. 10), shown from the window which overlooks it in the dining-room, is such an effective screen that, as you see, the photographer did not even detect the milk bottles; while from the point of view of execution the hexagon is simplicity itself.

The porte-cochère is another concrete innovation (Fig. 11). Note the simple columns and the wire glass inserted between the beams—translucent but not transparent—giving the advantages of the marquise entrance in an inexpensive way.

Last of all, perhaps most important of all, for the exterior, is the question of color and texture. As practical cement men, you are, of course, familiar with different surface finishes—sand float, pebble dash, smooth wash—none of which are completely immune to scaling and cracking. I believe we have to thank Mr. Albert Moyer for the first practical application of the exposed selected aggregate method to house and decorative purposes. My own experience is that the aggregate exposed only so much as is accomplished by scrubbing with water while green is far the most durable and the most attractive (Fig. 7). Where the aggregate is well chosen,—as for instance, a local gravel containing much pinkish quartz pebble,—the

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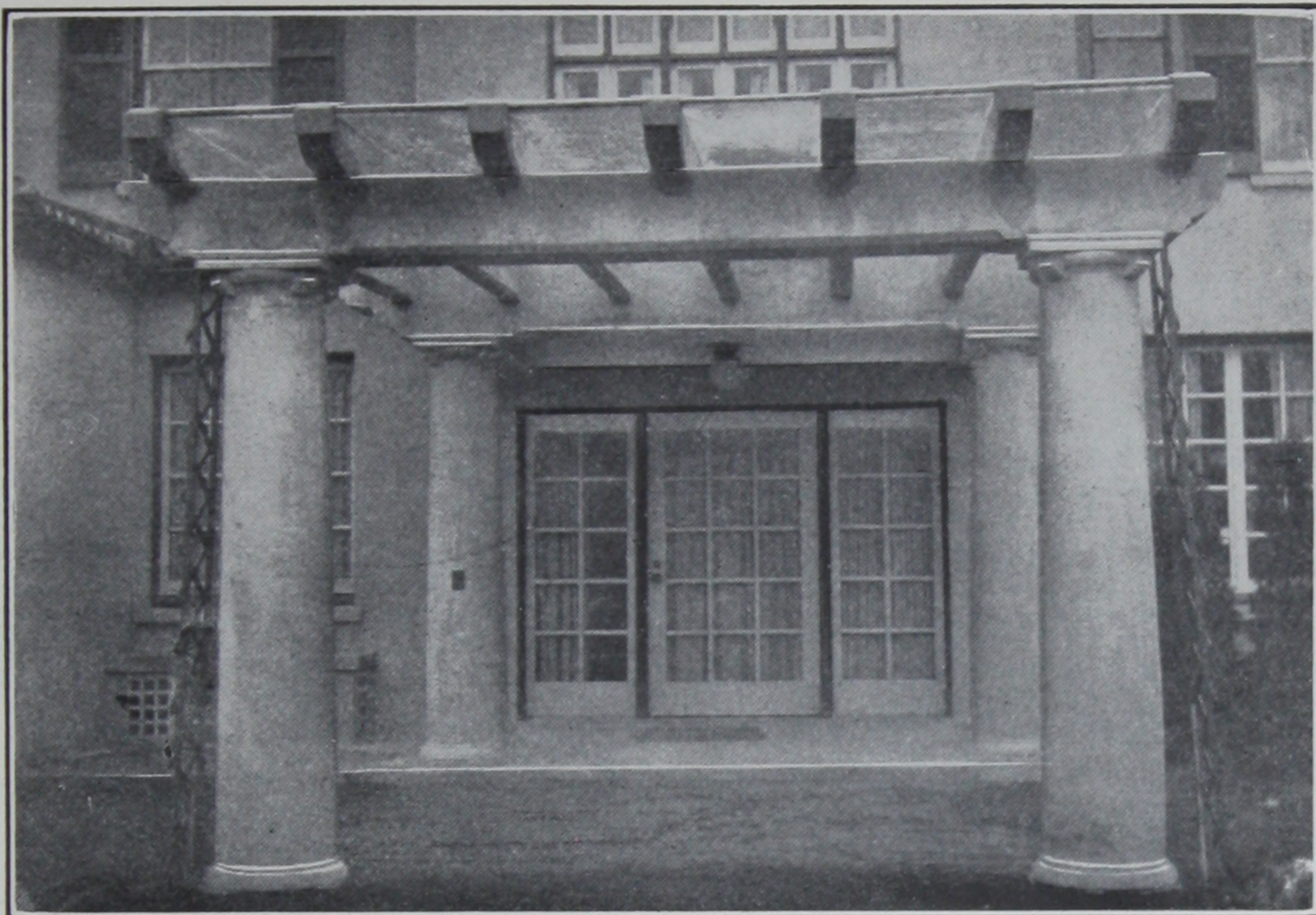


Fig. 11.—Porte-cochère, DeLanoy house.

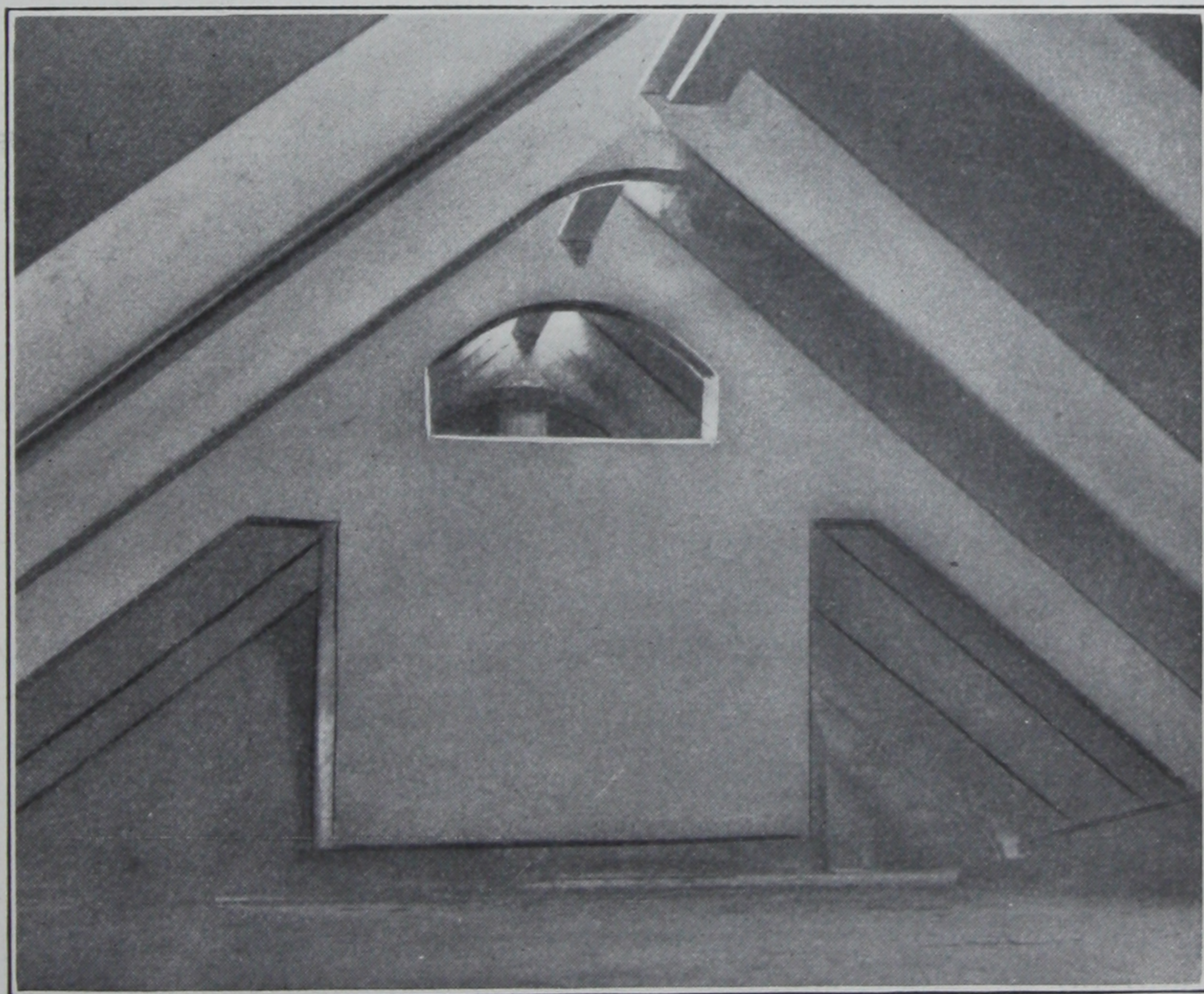


Fig. 12.—Ridge-pole and suspended water-tank, Hinsdale Smith house.

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result in color and texture is surprisingly good—a mellow bloom that it is hard to believe is not the product of centuries.

As to the surface decoration, I believe that ornament flush with the wall is most desirable; in general, mosaic for monumental or city work; mosaic brick-work, especially brick in the blue and purple tones, for city or suburban houses; for country houses variations in texture, as about the window shown, or possibly fresco. A most interesting result has been obtained at my suggestion on a house on Long Island where formal designs were stencilled on the walls (that is, on the window panels and under the eaves) with a mixture of sand, cement, and pigments, and a year's exposure to the elements has, in the architect's judgment, made the colors only more harmonious with their cement background.

Finally, as to waterproofing the surface: and here I know that I shall make a statement surprising to some. I do not consider waterproofing in general necessary; it is all a question of mixture. With a sufficiently "rich mix" you can keep out a Jamaica hurricane. Contrary to the assertions of certain business rivals of concrete, contrary even to the belief of earnest advocates of concrete, the material is not necessarily permeable. You have seen several views of a suspended water-tank (Fig. 12) with capacity of 2000 gallons. There is no waterproofing there. In the view to which I recur (Fig. 2) there is a water-tank behind the wall to the right, with capacity of 4000 gallons—no waterproofing there. It is usually truer economy to lavish cement and make your wall tight than to skimp cement and then waterproof.

Let us turn now for a word as to the outbuildings, garages, stables, etc. Of course, the main lines of the garage should be those of the house, with flat or slightly sloping roof, if built, in the usual way, as a separate structure. But it is the especial advantage of the all-concrete house that the fire risks of the garage need not be feared, and accordingly we see the garage below the kitchen (Fig. 13), with sunken entrance, or in the extension beyond the kitchen wing (Fig. 4). Here there is generous room for two machines.

Passing now to the interior; what of the objection, so often made, to the alleged bareness, coldness, and discomfort of the all-concrete house? A short time ago I should have answered all such inquirers by reminding them that even the reinforced concrete house—the unburnable house—may be finished inside with wood. To-day I should do so with reluctance. Recent experience, the disastrous fire in the Draper residence in Boston, has shown that the supposed

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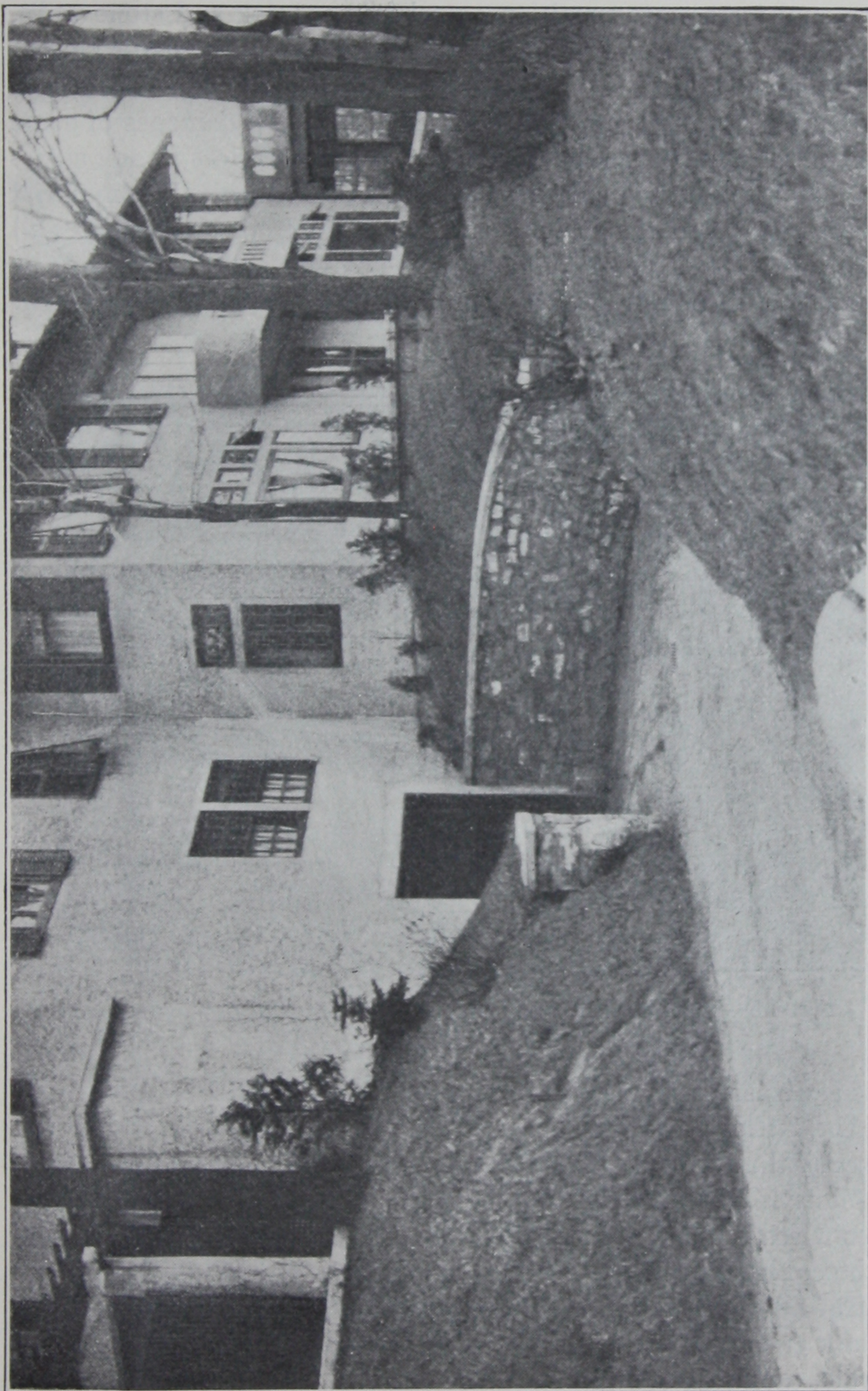


Fig. 13.—Garage with sunken entrance below kitchen wing. Residence of Maitland F. Griggs, Esq., Ardsley-on-Hudson.
R. W. Gardner, Architect; Benj. A. Howes, Engineer.

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completely fireproof house, with reinforced concrete floors and staircases, and terra-cotta partitions, steel frame, brick and stone walls, but heavy and elaborate interior finish of wood, burns like a tinderbox if the wood catches. The Draper fire, where the wooden floor was ignited by an electric plate warmer, entailing damages of some \$500,000, demonstrates the danger of wooden interiors in any structure. The unburnable house must be of unburnable material throughout. And that this need not detract from its warmth and livableness, I believe the following views will show. Concrete is never harsh-looking where its natural qualities are frankly accepted.

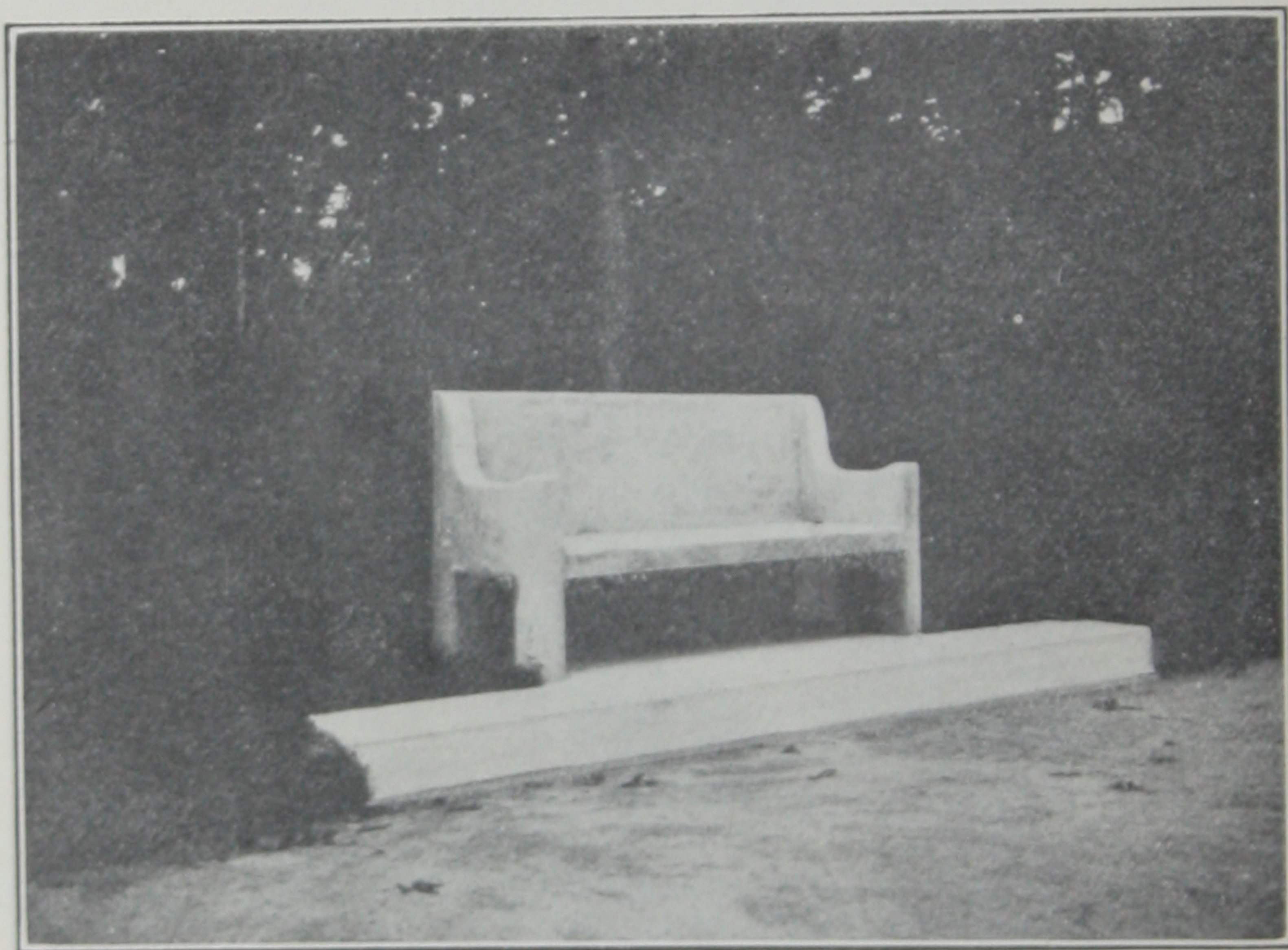


Fig. 14.—Reinforced concrete bench, tennis-court, DeLanoy house.

This staircase (Fig. 15), for instance, is of solid reinforced concrete, but the design (very practical and economical, too) so well suits the material that it seems entirely in place in this warm, sunny hall. The floor is of red-brown tile, and walls are of fine concrete blocks, given a rich texture by brushing while soft, and colored a deep cream in the concrete itself.

The adjoining room, with the same walls, is floored with terrazzo of dark green and white marble chips, while the fireplace is of Istrian marble—an antique find.

A chapter could be written on fireplaces of concrete. There is

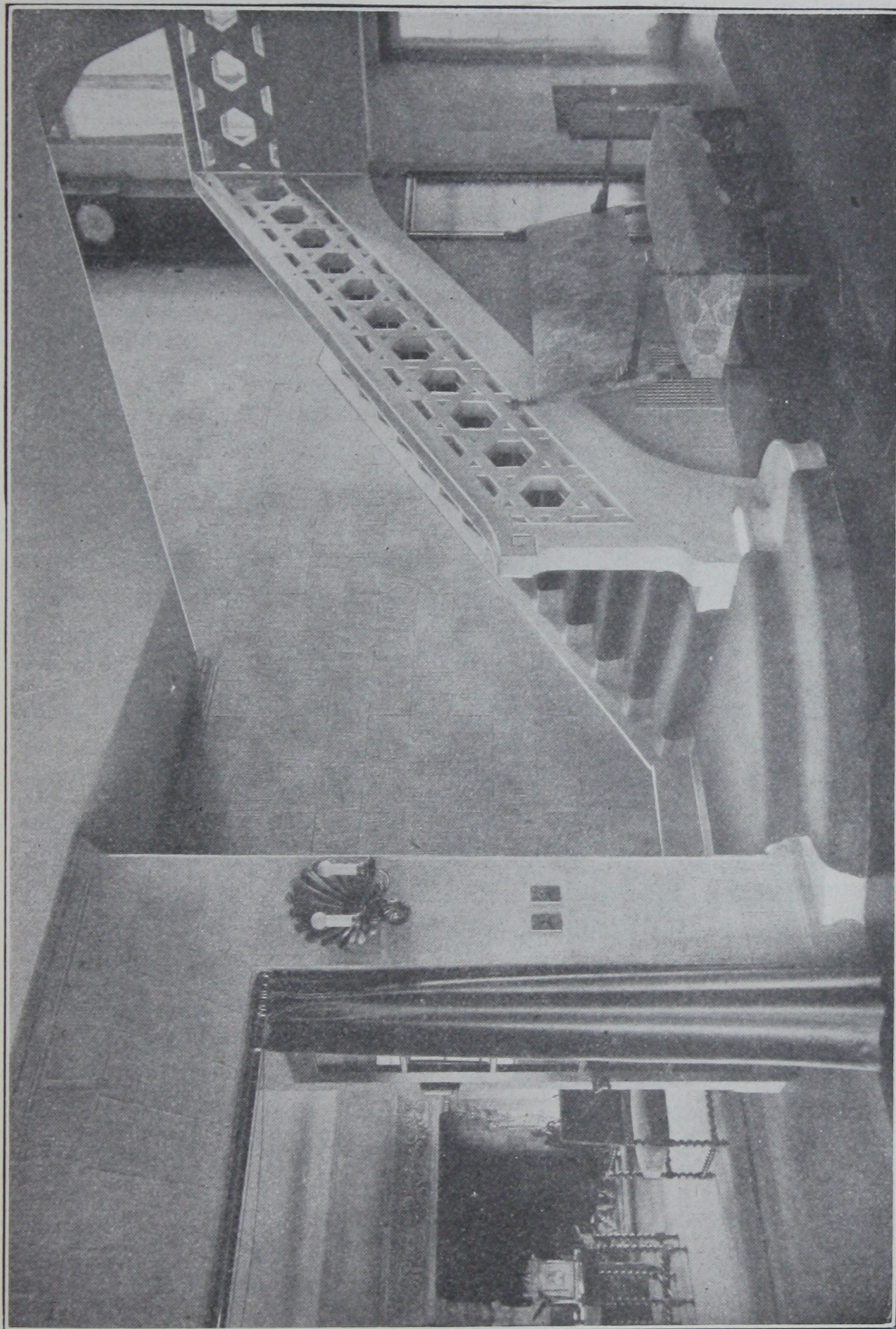


Fig. 15.—Stairway and entrance to library, DeLanoy house.

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the tooled reproduction of the Italian fireplace—laborious and costly, but very effective. There is the original concrete fireplace, with sculpture done in place, of modeller's cement; and there are the simple, straightforward concrete slabs, sometimes with variation of texture, sometimes without.

A recent example not yet complete is this all-concrete fireplace (Fig. 16) from the South Hadley house. The side-pieces are intended to carry ornamental lamps and are wired for electricity. In this room are also the tapering beams, which were deep because they are of very wide span, and would have given a very heavy effect if they had not been cut away as you see.

As to floors in general, concrete can be painted any color, stained in pleasing tones, or tinted by pigments mixed in the concrete. Tile is expensive; terrazzo perhaps the most satisfactory compromise. However, I look for the establishment of standard methods for the concrete floor, in the immediate future; when these are available, it will be both the cheapest and best.

Perhaps it may be of interest to illustrate the relation between reinforced concrete interior construction, and an exterior, which, for one reason or another, cannot be of concrete. The case would often occur for city buildings of all kinds, including dwellings, if the demand for the truly fireproof structure were insistent and sincere with all owners of valuable objects. Even for country houses the same desire for an outside other than concrete might prevail. The example, on a small scale, is the framework (Fig. 17) of a mausoleum to be covered with warm-toned granite, and lined throughout with marble (Fig. 18). For this building the concrete structure shown represents about 6 per cent. of the total cost.

Retreating now to the garden and grounds, little need be said of garden furniture. The output of concrete benches, fountains, sun dials, etc., by numerous firms is of the highest character, technically, and offers the widest opportunity for selection. In general, the spirit of concrete seems to demand bold, simple, moulded outlines, and where the work is to be done in connection with the building of the house, must be of that type. The design for bench and table, herewith given, was modelled from a picture by Alma Tadema. The lantern-post (Fig. 19) and tennis bench (Fig. 14) and fence-post (Fig. 20) were easily done "on the job."

For my last word on the reinforced concrete house from the builder's point of view, I believe that a frank expression of opinion to the producers of cement may be of use. There is at present wide-

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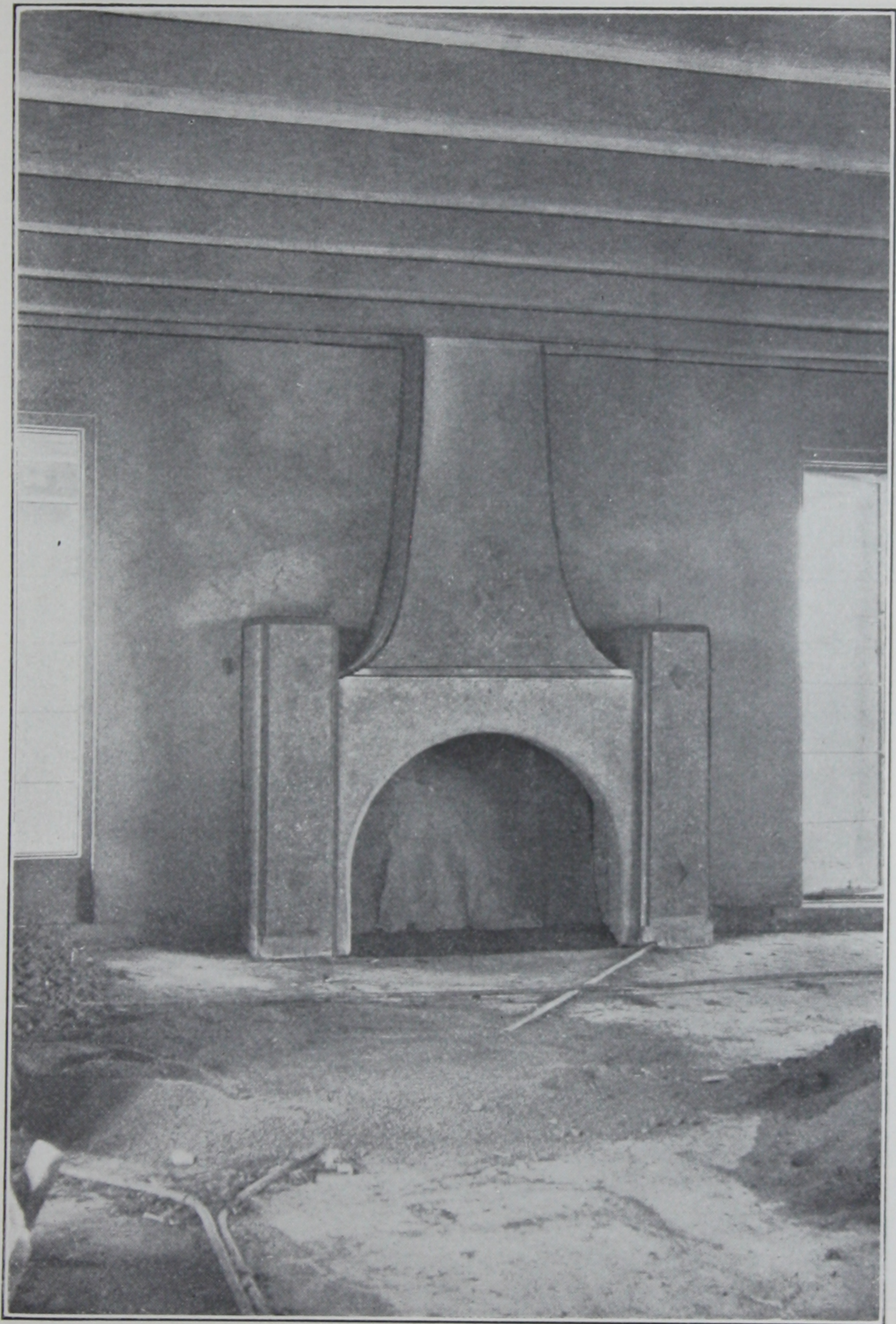


Fig. 16.—Concrete fireplace, unfinished, Hinsdale Smith house.

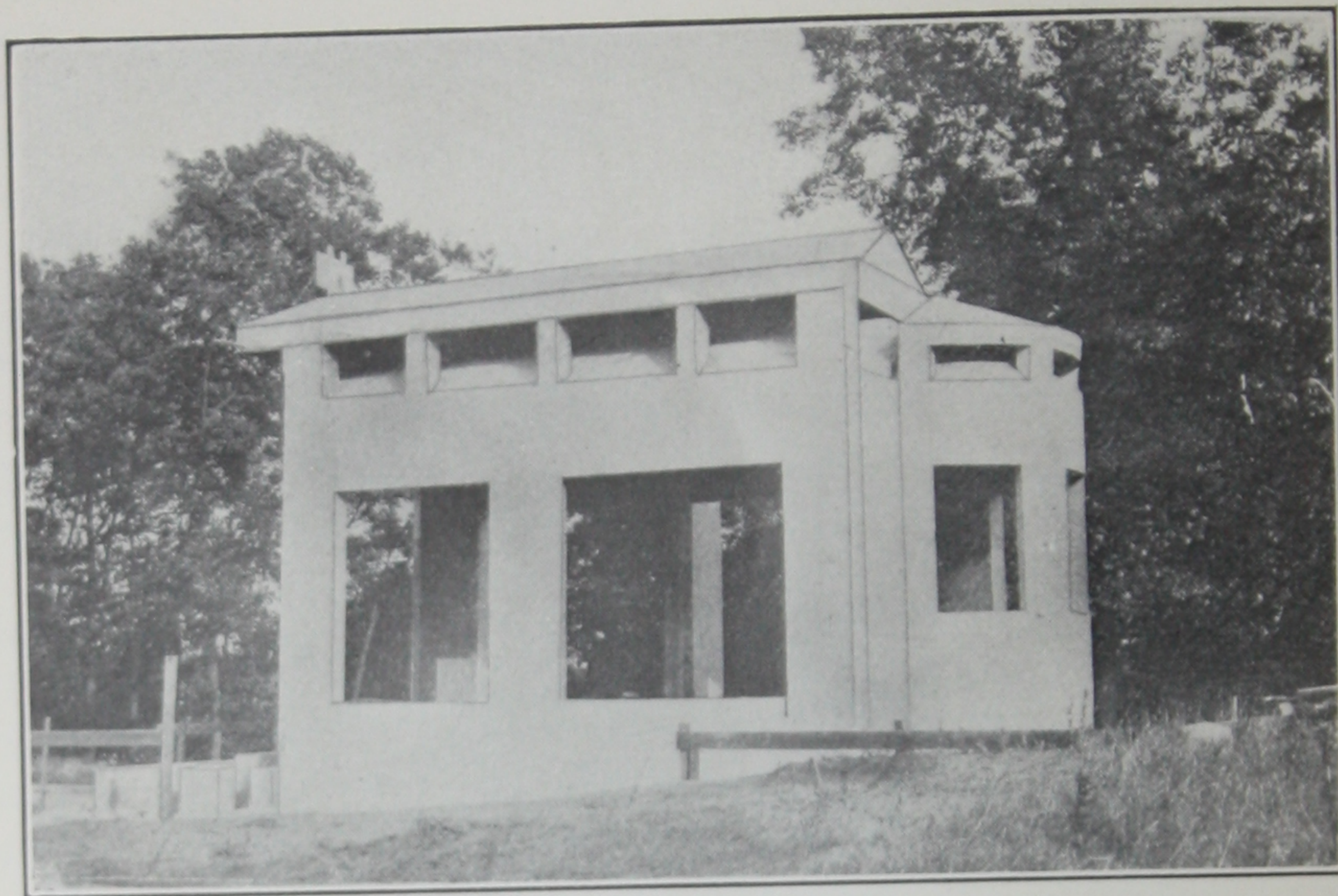


Fig. 17.—Framework of mausoleum shown in Fig. 18.



Fig. 18.—Mausoleum, Morristown, N. J. Chas. W. Romeyn, Architect; Benj. Howes, Engineer.

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Fig. 19.—Reinforced concrete lantern-post, DeLanoy house.

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spread misapprehension, not only on the part of owners, but on the part of real estate men themselves, as to what the concrete house really is. When they talk about concrete, they are often referring to cement plaster (so-called stucco) as a veneer on some other material. The error is almost impossible to eradicate. The other day I gave a talk on the reinforced concrete house before an Arts and Crafts Society, even with diagrams of methods of construction; but after the lecture a lady came to me and said she had been so much interested in my talk—she was building a concrete house herself. “Solid concrete?” I asked. “Oh, well, she didn’t know about that”—it turned out to be stucco on brick. Now, I should be the first to advocate stucco on concrete block or clay tile when a low first cost is imperative; but no man who can afford the first cost of reinforced concrete is going to build in stucco—if he understands the difference. To-day thousands, nay, millions, of dollars are going into stucco houses (on other appointments of which owners are ready to squander money) merely because the owners are ignorant of this important distinction. Now, as the cement going into a stucco house is but one-third to one-half that in the true concrete house, it would certainly be to the interests of the cement companies to seek all available publicity for the true distinction, in construction and in quality, between the solid concrete house and the cement plaster veneer. Certainly I cannot think it for their ultimate advantage to give widespread publicity to houses as being, at least inferentially, of true concrete, where they are really of the flimsiest, most burnable construction, simply plastered over. The best advertisement of cement, and the best interest of the cement companies, lies in the public understanding of the value of the solid reinforced concrete house.

Fortunately the case of cement and concrete is like the case of the automobile. The automobile has not caused us to lose appreciation of the value and noble qualities of the horse; in the same way, I believe, the especial virtues and properties of other building materials will be more highly valued, the more we work for a clear understanding of the vital differences between them and the products of cement.

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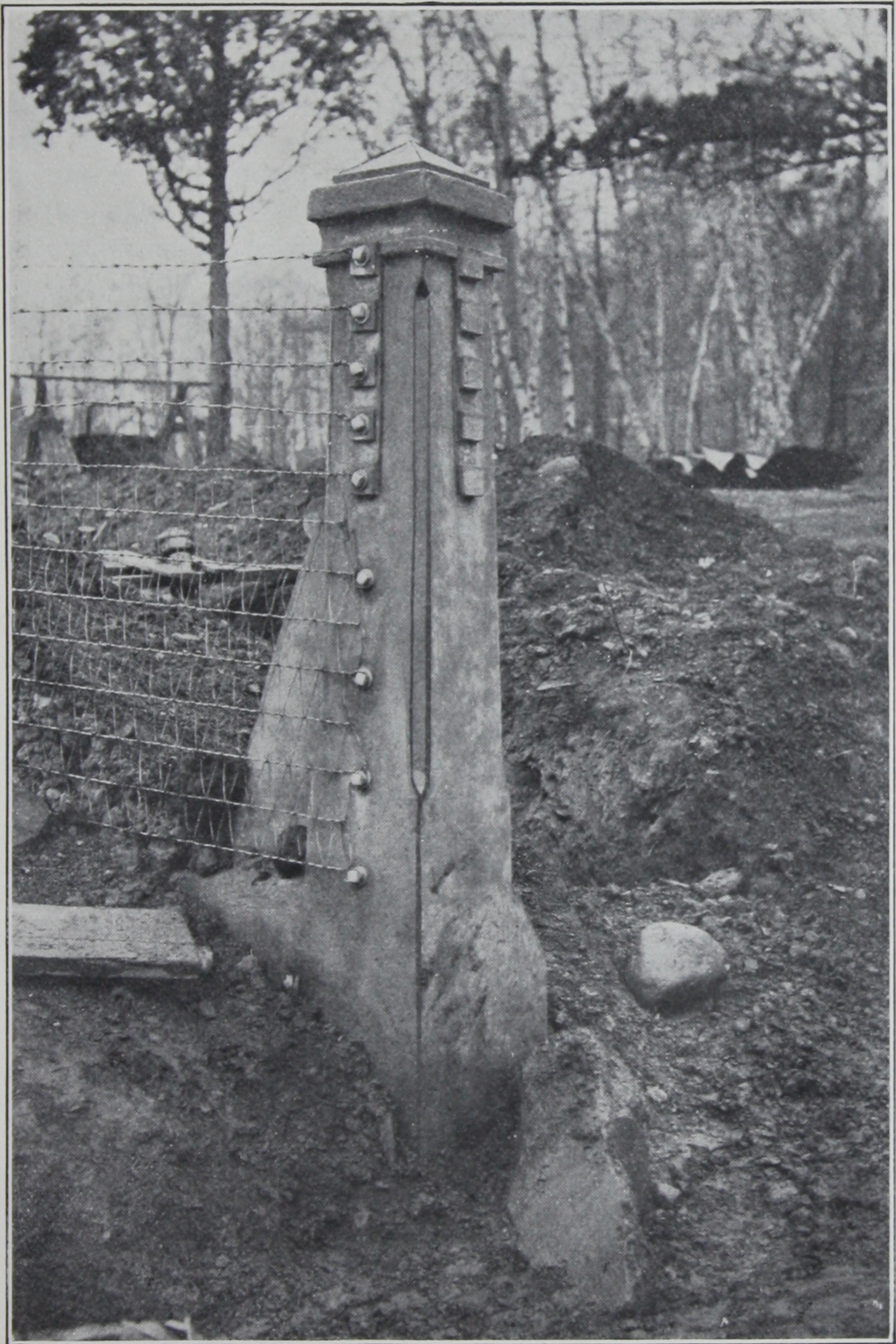
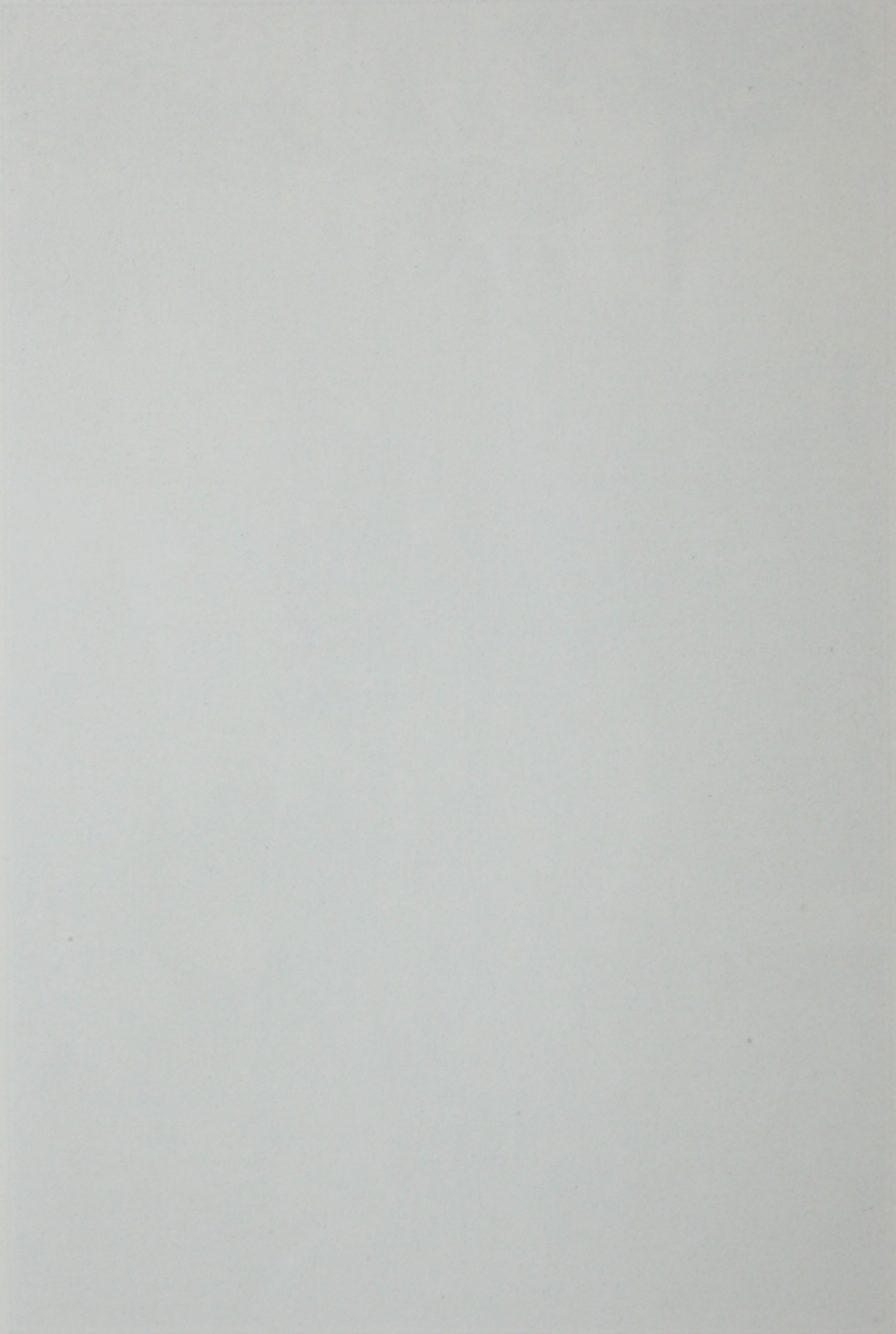


Fig. 20.—Reinforced concrete fence-post, DeLanoy house.



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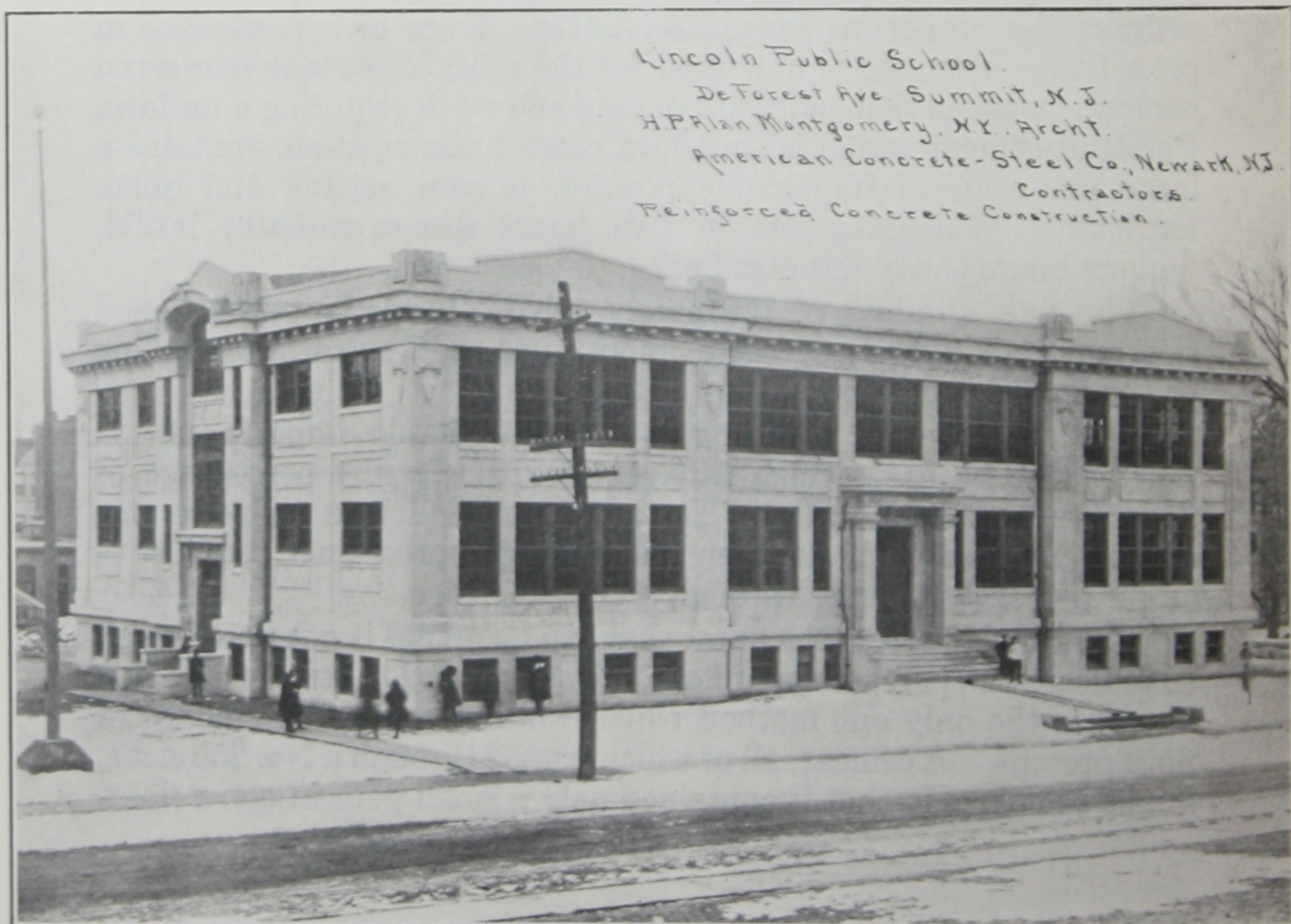
The fine grinding of intimately mixed, properly proportioned raw materials is of far greater importance than extra fine grinding of the finished product.

The character of grinding is of considerable importance. A mill should be used which will produce the largest percentage of flour (impalpable powder). Do not be misled into thinking one cement is finer than another (containing more flour), because a larger percentage passes through a No. 200 sieve.

The No. 200 sieve (the finest that can be made) is not fine enough to indicate the percentage of flour. The elutriation test (suspension in air) is the only one method which will determine the amount of flour present. A cement, all of which passed through a No. 200 sieve, might be coarse in that it contained only a small percentage of flour.



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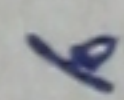
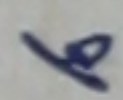
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